the galactic plane, with nodes in longitude 70° and 250° (figs. 4*a* and 4*b*); (d) the diameter is of the order of 2500 light-years.

The above results lead to a simple interpretation of star-streaming. The motion of an open cluster through the general star-fields of the equatorial segment must give rise to stellar drifts, and it is a natural assumption that the observed streaming in the neighborhood of the sun is wholly due to such a cause. According to this view, stars of Stream I belong to the large moving cluster surrounding the sun; those of Stream II belong to the galactic field. The motion of the cluster as a whole is in the galactic plane, nearly radial from the galactic center, and there is considerable evidence of internal motion within the cluster. In all the details examined, this hypothesis appears to be in agreement with the observed systematic motions of the stars.

[1] Shapley, H., these PROCEEDINGS, **3,** 1917, (479–484); *Mt. Wilson Communication*, No. 37.

[2] Slipher, V. M., *Popular Astronomy, Northfield, Minn.*, **26,** 1918, (8).

[3] Charlier, C. V. L., *Meddelanden fran Lunds Astro omiska Observatorium, Upsala*, (Ser. 2), No. 14, 1916, (1–108).

GLACIAL DEPRESSION AND POST-GLACIAL UPLIFT OF NORTHEASTERN AMERICA

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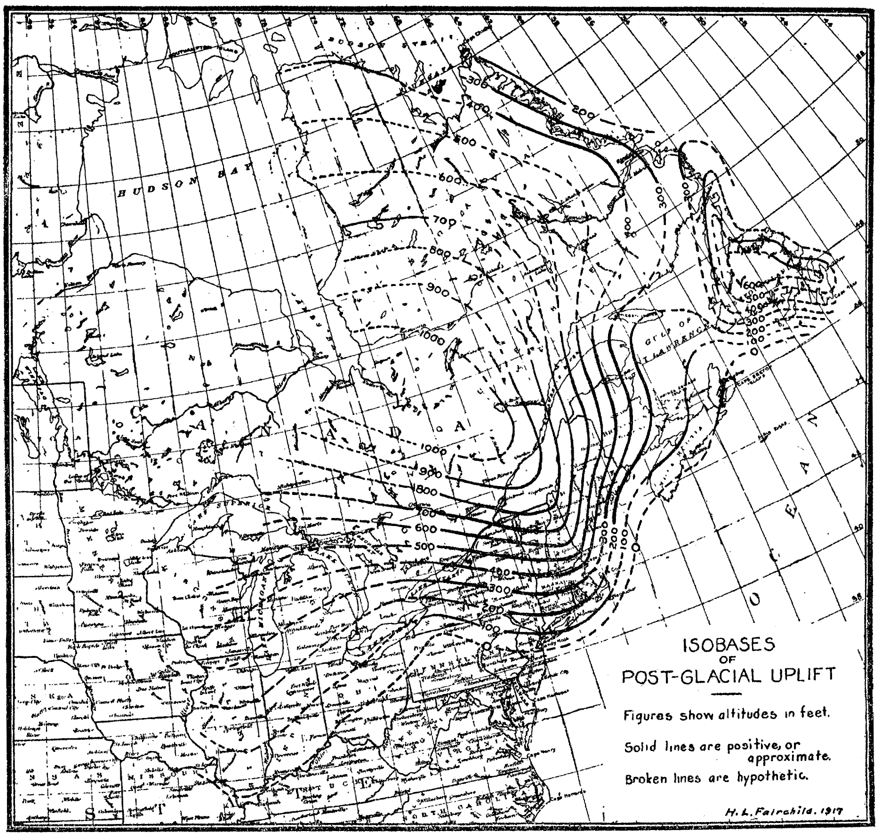
The geophysical theory of isostacy is excellently illustrated by the up and down (diastrophic) movements of northeastern America in relation to glaciation. The amount and the area of land depression beneath the ice sheet, and the land uplift subsequent to the removal of the ice, is fairly proportionate to the thickness and extent of the latest ice cap.

The fact is evident that the area covered by the latest continental ice sheet, the Labrador (Quebec) glacier, stood much beneath its present altitude, relative to sea-level, when the ice melted off; and that the recent uplift has brought the land to its present position. The evidence of the uplift is abundant; many high-level beaches and sand-plains facing the open sea and extending far up the valleys in Canada, New England and New York, with the occurrence of abundant marine fossils hundreds of feet above the ocean. These facts have been recognized for quite a century, and many observations are recorded in the geologic literature of Canada and America. But up to the present time the full amount of submergence and the extent or limits of the drowned area have not been determined beyond dispute. The full amount of the down-and-up movement has nearly always been underestimated, because the conspicuous or more evident marine features are generally of inferior and later

water levels, while the initial or summit features are commonly weak and unobtrusive; or the latter lie so far inland and are so detached as to be unrecognized in their genesis and relationship, being commonly referred to glacial origin. However, the summit or initial level at any point is the critical and essential element in the problem.

Several years of study in the Hudson-Champlain, Ontario and Connecticut valleys has determined the position of the uplifted and tilted marine level.



In the Hudson-Champlain Valley the ancient estuary features rise from zero south of New York City to 740 feet on the north boundary of New York, and to over 800 feet on the north line of Vermont. Comparison of these features with similar phenomena in the Connecticut Valley gives the direction of the isobases (lines of equal uplift) as 20 degrees north of west by south of east; or 20 degrees east of north for the direction of steepest tilting. This figure is in close agreement with the determinations of Coleman, Goldthwait, Spencer and Taylor for the later deformation of the glacial lake shore lines in the Great Lakes area.

It has also been found that in the Ontario Basin the vertical interval between the tilted plane of Lake Iroquois and the plane of the sea-level waters (Gilbert Gulf) is 290 feet. Extension of the isobases of total uplift westward over the Ontario Basin gives very close accordance with the facts of observation in that field.

With the large area of New York State, Ontario basin and western New England as a well-determined base it has been possible to extend the study eastward over New England and eastern Canada. The result is shown in the accompanying map with at least close approximation to accuracy. On the small scale the map is somewhat generalized. The broken lines are entirely hypothetic only in the Mississippi Valley, where the land uplift may be more complicated in time and form. Except in the district west of Indiana and Michigan the map shows the rise of the continent subsequent to the removal of the latest ice sheet.

For Laborador and Newfoundland reliance is placed on the published data of R. A. Daly, with some help from unpublished figures of A. P. Coleman and J. B. Tyrrell.

Precaution is taken in this study to discriminate between features produced by sea-level waters and by glacial waters. In the inland areas, in order to avoid doubt or cavil as to glacial waters, the main dependance has been placed on the summit deltas of streams with southward flow, or with flow directed away from the receding ice margin. In the extended paper, noted below, will be found a description of field methods, and discussion of criteria for discriminating marine features.

The map shows apparently direct relation between the ice sheet and the diastrophic land movement. The area of uplift is the area of glaciation, and the amount of uplift is proportionate to the supposed thickness of the spreading ice cap. The map also shows the effect of land and sea on the flow and reach of the ice sheet. The ice deployed on the land but was inhibited by the sea; thus producing more rapid flow and steeper gradients along the radii toward the nearer sea shores. An independent ice cap is indicated for Newfoundland.

For the fuller discussion, in both methods and results; for description of the uplifted sea-level features in western New England, Maine, St. Lawrence and Ottawa valleys, Gaspé peninsula, New Brunswick, Nova Scotia, Labrador and Newfoundland; and for discussion of possible effects of any change in ocean level, the reader is referred to the formal paper in the *Bulletin of the Geological Society of America*, volume 29.

Former papers by the writer bearing on the subject of recent land uplift are as follows:

Pleistocene marine submergence of the Connecticut and Hudson Valleys, *Bull. Geol. Soc. Amer., New York*, **25**, 1914, (219–242).

Pleistocene uplift of New York and adjacent territory, *Ibid.*, **27**, 1916, (235–262).

Post-Glacial marine waters in Vermont, *Burlington, Rep. Vermont State Geologist for* 1915–16, **1917**, (1–41).

Poat-Glacial submergence of Long Island, *Bull. Geol. Soc. Amer.* **28,** 1917, (279–309).
Post-Glacial features of the upper Hudson Valley, *N. Y. State Museum, Bull.,* 195, 1917.
Post-Glacial uplift of northezastern America *Bull. Geol. Soc. Amer.,* **29** (in press), 1918.

A BACTERIOLOGICAL STUDY OF THE SOIL OF LOGGERHEAD KEY, TORTUGAS, FLORIDA

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Communicated by A. G. Mayer, May 21, 1918

Inasmuch as the coarse calcareous sands of the islands off the Florida Coast, and of similar ones, represent very recent geological material, and since they, therefore, offer an opportunity of determining the early bacterial flora which establish themselves there, it was decided to carry out some studies on typical samples. Dr. A. G. Mayer, Director of the Marine Biological Laboratory of the Carnegie Institution, situated on Loggerhead Key, Tortugas, Florida, supplied us with the neccssary samples for our study. Three large samples were collected, which answer to the following descriptions, for which we are indebted to Dr. Mayer:

No. 1. In region thickly covered with *Suriana maritimı* bushes. About twenty feet north of stone wall built in 1868 and in a place where probably no man has trodden for 30 years or more. This sample is of an average depth of about 7 inches beneath the surface.

No. 2. Sand from the surface to 6 inches in depth from the northern end of Loggerhead Key. The region is barren of vegetation, no plants having ever grown within 200 feet of the place from which sample was taken. It is about 6 feet above high tide level on the crest of the island. Probably no man has walked here for 10 months previously.

No. 3. From an average depth of 15 inches below the surface in a place densely wooded with *Suriana maritima.* Same locality as Sample No. 1.

We thus had a soil and a subsoil sample from a part of the island in which large bushes (*Suriana maritima*) have established themselves as a permanent association. We also had a surface sample of very coarse, white, calcareous sand or grits, on which plants have never grown. It is to be noted, also, that there has been little or no opportunity for the contamination of these samples by the habitation or tread of man. The flora which now characterize the soil or sand material must take their origin either from the sea water, which now surrounds and which at one time probably covered them, or from winds carrying dust from older soils. The samples were collected by Dr. Mayer with the greatest care, large sterile bottles with cotton stoppers having been employed as containers. The cotton stoppers were doubly protected against contamination while in transit.

The studies carried out included counts of bacteria in the various samples, isolation and identification of pure cultures of the important bacteria and